

READING PASSAGE 2

You should spend about 20 minutes on **Questions 14-26**, which are based on Reading Passage 2 below.

REMOVING UNWANTED NOISE

A A noisy restaurant, a busy road, or a windy day are all situations that can be intensely frustrating for the hearing impaired when trying to understand what other people are saying. Some 10 million people in the UK suffer from hearing difficulties and, helpful as hearing aids are, those who wear them often complain that background noise continues to interfere with their understanding. But what if hearing aid wearers could choose to filter out all the troublesome sounds and focus just on the voices they want to hear?

Engineer Dr Richard Turner believes that this is fast becoming a possibility. He is developing a system that identifies the distracting noise and 'rubs it out'. 'The poor performance in noise of current hearing devices is a major reason why six million people in the UK who would benefit from hearing aids do not use them,' he said. Moreover, as the population ages, a greater number of people will be hindered by the inability to hear clearly. In addition, hearing-impaired patients who have been fitted with cochlear implants – devices implanted to help those whose auditory hair cells have died – suffer from similar limitations.

B The solution lies in the statistics of sound, as Turner explained: 'Many interfering noises are immediately recognisable. Raindrops patter on a surface, a fire crackles, talkers babble at a party and the wind howls. But what makes these different noises sound the way they do? No two rain sounds are identical because the precise arrangement of falling water droplets is never repeated. Nonetheless, there must be statistical similarities in the sounds of these raindrops compared with, say, the crackle of a fire.' He believes that for this reason, the brain may be able to group similar types of sounds together based on their specific characteristics.

Turner and his colleagues have analysed this process mathematically and then developed algorithms that mimic what the brain is doing. The mathematical system that they have developed is capable of being 'trained' – a process that uses new methods from the field of machine learning – so that it can recognise new sounds. 'Rather surprisingly, it seems that a relatively small set of statistics is sufficient to describe a large number of sounds' he says. Crucially, the system that Turner and his team have come up with is capable of telling the difference between speech and other types of sound.

C 'What we can now do is to erase background noise and pass these cleaned-up sounds to a listener to improve their perception in difficult surroundings,' said Turner. The idea is that future devices will have several different modes in which they can operate. These might include a mode for travelling in a car or on a train, a mode for places like a noisy party or a busy restaurant, a mode that can be used outdoors in windy weather, and so on. The device might intelligently select an appropriate mode based on the characteristics of the incoming sound.

D 'In a sense we are developing the technology to underpin intelligent hearing devices,' said Turner. An additional possibility would be for users to override the selection made by the device and select a processing mode based upon what sorts of noise they wish to erase. They could even guide the processing on their device using an interface on a mobile phone through wireless communication. Turner anticipates that his team will need two more years of simulating the effect of modifications that clean up sound before they start to work with device specialists. 'If these preliminary tests go well, then we'll be looking to work with hearing device companies to try to adapt their processing in order to incorporate these machine learning techniques.'

E Tinnitus sufferers, who are plagued by a constant ringing in their ears, could also benefit from the technology. At present, people with tinnitus sometimes use environmental sound generators as a distraction from the ringing in their ears. But such generators offer only a limited selection of sounds – a gently flowing stream, waves lapping on the seashore, or leaves rustling. With the new technology, individual patients could select the best sound to distract them from their tinnitus.

F The technology not only holds promise for helping the hearing impaired, but it also has the potential to improve phone calls – anyone who has ever tried to hold a conversation with someone phoning from a crowded room will recognise the possible benefits of such a facility. Systems that can deal with unwanted audio content would also be welcomed by the increasing numbers of people using video-sharing websites. For example, a video containing a conversation that takes place by a busy roadside on a windy day could be made more intelligible by isolating the speech from the noises – users could even be offered the chance to de-noise their video during the upload process.

Questions 14 – 19

The text has six sections, **A – F**.

Choose the correct heading for each section from the list of headings below.

Write the correct number, **i – ix**, in boxes 14 – 19 below.

List of Headings

- i** How hearing loss may be caused by certain types of sounds
- ii** Uses for Turner's research in media and communications
- iii** Creating a model for the classification of sounds
- iv** Potential developments that still require further research
- v** A drawback in the help currently available to those with hearing problems
- vi** Providing the hearing-impaired with training in new technology
- vii** A more effective way to take attention away from a hearing problem
- viii** Analysing the sounds produced in the process of speaking
- ix** The possibility of a hearing aid that can adjust itself to different environments

- 14 Section A _____
- 15 Section B _____
- 16 Section C _____
- 17 Section D _____
- 18 Section E _____
- 19 Section F _____

Questions 20 – 23

Complete the summary below.

Choose **NO MORE THAN TWO WORDS** from the passage for each answer.

Write your answers in boxes 20 – 23 below.

Improving the performance of hearing aids

At present, many people find their hearing aids do not work well when there is background noise. This also applies to people without hearing aids who have had implants fitted to help with hearing loss. Dr Richard Turner is looking for a solution to this problem. Although sounds are never **20**....., he believes they do share some similarities. He and his colleagues have worked on a mathematical system using **21**..... which replicate how we hear sounds. To allow this system to be 'trained', they have applied procedures used in machine learning and found that many different sounds can be described using a limited number of **22**..... They have now developed a system that can distinguish **23**..... from other sounds.

Questions 24 – 26

Choose the correct letter, **A, B, C or D**.

Write the correct letter in boxes, 24-26 on your answer sheet.

24 Turner's team are now planning a new development involving a device which could

- A** allow sound to be heard at a greater distance.
- B** adapt itself to different kinds of background noise.
- C** allow a user to remove all types of sound completely.
- D** adapt itself to disorders involving other senses.

25 In **section E**, a stream, waves and leaves are examples of the sounds that tinnitus sufferers

- A** can currently use to help their condition.
- B** might choose to use if they were available.
- C** hear in their ears as a result of their condition.
- D** find to be the most natural solutions to their problem.

26 The writer refers to '*a busy roadside on a windy day*' in **section F** to illustrate that

- A** unwanted noise could be erased from video recordings.
- B** some environments are difficult for the hearing-impaired.
- C** when noises are combined in a video they are difficult to erase.
- D** - people must cooperate in order to learn how to apply the technology